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(71) Applicant: SHELBY WILLIAMS INDUSTRIES, INC. [US/US]; 5303 Tennessee Boulevard, Morristown, TN 37814 (US).					
(72) Inventor: TOLLESON, Thomas, H. ; 1540 Prater Drive, Morristown, TN 37814 (US).					
(74) Agents: CASS, Myron, C. et al.; Silverman, Cass & Singer, Ltd., 105 West Adams Street, 27th Floor, Chicago, IL 60603 (US).					
<b>(54) Title: CONCEALED FLEXIBLE BACKREST FRAME ASSEMBLY FOR A CHAIR</b>					
(57) Abstract					
<p>A flexible, articulated backrest frame assembly adapted to be installed between a backrest member (98) and a chair seat member (88) to form a flexible backrest for a chair. The frame assembly includes a lower frame part (86) having a pair of hollow, spaced apart frame members (104) joined together at one end of each and open at their opposite ends (110) and an upper frame part (84) having a pair of hollow, spaced apart frame members and open ends (96) in registry with the open ends of the lower frame members. Spring members (50) are secured between the open ends of the frame members to provide an articulated flexible spring connection between the upper and lower frame parts. The frame parts include members (100, 106) for attaching same to a backrest member and chair seat member respectively to form the flexible backrest for the chair. A resilient cover (120) can enclose the backrest frame assembly.</p>					
<img alt="Technical drawings of the backrest frame assembly. The top drawing shows a side view of the frame parts (84, 86) and spring members (50) with various component labels (98, 100, 102, 104, 106, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 400, 402, 404, 406, 408, 410, 412, 414, 416, 418, 420, 422, 424, 426, 428, 430, 432, 434, 436, 438, 440, 442, 444, 446, 448, 450, 452, 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CONCEALED FLEXIBLE BACKREST FRAME ASSEMBLY FOR A CHAIR

This application is a continuation-in-part of U.S. Serial No. 07/244,663 filed September 14, 1988, the disclosure of which is incorporated herein by reference.

5 The related applications are owned by a common assignee.

TECHNICAL FIELD

10 This invention relates generally to chairs having flexible, articulated backrests and more particularly, to a backrest frame assembly for a chair, said assembly having upper and lower frame parts joined by a flexible spring assembly, the backrest frame assembly being installed concealed between the backrest and seat of the chair.

BACKGROUND ART

15 Chairs having articulated, flexible backrest parts for achieving desired support and comfort for the user are known in the art. Such, chairs are used, for example, in banquet and conference facilities where back comfort for the seated individual is desirable. Chairs 20 of this type typically are stackable and have molded backrest parts and peripheral frame parts of hollow construction to enable interconnection of upper and lower backrest parts which are flexible one relative to the other. Various types of flexible spring arrangements for joining the upper and lower backrest parts of such chairs 25 are known. An example of such a spring arrangement is disclosed in U.S. Patent No. 4,603,904 which is assigned to the same assignee as the assignee herein.

30 The chair disclosed in Patent No. 4,603,904 includes an articulated, flexible backrest having a spring means that includes an elongated plastic support strut having a hollow passageway that is fitted with a flexible core. The flexible core comprises a wire cable or the like whose structural specification is selected to limit to 35 some degree the flexing angle of the backrest's upper part. The spring means serve positively to join the upper and lower backrest portions to prevent

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translational movement th rebetween. As the spring means are flexed, the wire cable secured in the passageway of the plastic support strut limits the elongation and ultimate yield or breaking point of the strut. The cable 5 controls elongation of the strut to permit flexing and yet prevents tensile failure by insuring that the plastic support strut is not flexed beyond the tensile limit of the material from which it is constructed. A problem encountered with this structure derived from change in 10 characteristics of the wire cable and spring strut after extended periods of time or unusual use or abuse.

Thus, it is desired to avoid such problems by providing a flexible spring assembly which includes specially constructed holder means for the spring having restrictive engagement means which will not change in function 15 characteristics and yet prevent flexing of the spring beyond the tensile limit of the material from which it is constructed. One such flexible spring assembly is disclosed in parent application Serial No. 07/244,663 entitled FLEXIBLE BACKREST ASSEMBLY FOR A CHAIR which is 20 incorporated herein by reference. The flexible backrest frame assembly of herein invention includes a flexible spring assembly which joins upper and lower frame parts of a backrest frame assembly and is installed concealed 25 between the backrest and seat of the chair to provide a more aesthetically pleasing appearance while reducing interference with the spring assembly.

DISCLOSURE OF THE INVENTION

A flexible backrest frame assembly for a chair having 30 a lower frame part which can be connected to a seating frame and an upper frame part which can be connected to a backrest portion and which can overlay the upper frame part. The frame parts are interconnected by a pair of substantially identical flexibl 35 spring members secured between the lower and upper frame parts. Each spring member includes an elongated, flat or blade spring, preferably of laminated structure, having opposite ends.

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Each end of the spring is secured within a holder or channel member which is closed at one end and open at its opposite end for inserting the spring into the holder. The spring is secured within a holder or channel member 5 adjacent the closed end thereof and offset laterally from the longitudinal axis of the holder or channel. The open ends of each holder have stop flange formations protruding outwardly thereof. When the spring is secured in a pair of holders, the holders are spaced apart at their 10 open ends a predetermined distance or gap to effect limitation of the angle of flexure of the spring because of restrictive engagement of the flanges one with the other when the spring means are installed between the upper and lower frame parts. A resilient cover member 15 can enclose the backrest frame assembly to provide a smooth transition between the backrest and the seating frame and protect the backrest and the seating frame and protect the backrest frame assembly from foreign matter.

The upper frame part includes two lateral, hollow, 20 peripheral depending frame ends, and the lower frame part has two lateral, hollow, peripheral upstanding frame ends. The depending frame ends are arranged to be aligned, respectively, with the upstanding frame ends. The flexible spring members preferably are installed partially 25 within the interior of the hollow, aligned peripheral frame ends of the frame parts to extend outwardly from open extremities of the frame ends. The flanges of the holders are exposed exterior of the frame parts for effecting the restrictive movement engagement thereof so as to prevent the blade spring from flexing beyond the 30 tensile limit of the material from which it is constructed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a chair having the 35 flexible spring assembly embodying the invention of the parent application installed between the backrest frame portions thereof;

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5 FIG. 2 is a fragmentary longitudinal sectional view of a portion of the backrest frame portions of the chair having the flexible spring assembly installed, the backrest frame portions being in a non-flexed or at rest position;

10 FIG. 3 is a fragmentary view similar to that of FIG. 2 illustrating the backrest frame portions in flexed displacement;

15 FIG. 4 is a sectional view taken along line 4-4 of FIG. 2 and in the direction indicated generally;

FIG. 5 is a rear perspective view of a chair having the flexible backrest frame assembly and illustrating the protective cover embodying the invention;

20 FIG. 6 is a perspective view of the chair illustrating the flexible backrest frame assembly of the invention installed between the backrest and seat assembly thereof;

25 FIG. 7 is a fragmentary longitudinal sectional view taken along line 7-7 of FIG. 6 and in the direction indicated generally, illustrating the at rest position of the spring assembly with a flexed position shown in dotted outline; and

FIG. 8 is a perspective view of the frame parts and the flexible spring assembly with the seat assembly and backrest portions removed.

BEST MODE FOR CARRYING OUT THE INVENTION

30 FIGS. 1-4 are the FIGS. and corresponding disclosure of the parent application Serial No. 07/244,663 incorporated herein by reference. The spring means 50 also are utilized with the chair of the present invention.

35 Referring to FIG. 1, the chair is designated generally by the reference numeral 10. Chair 10 includes a frame 11 having an upper backrest portion designated generally 12 and a unitary seat and lower backrest portion designated 14.

The upper backrest portion 12 includes a peripheral, inverted U-shaped frame member 16 providing a pair of

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spaced apart, depending frame member ends 18 connected across the upper ends thereof by a curved bridging segment 20. A backrest pad or cushion 22 is secured between the frame member ends 18. Each frame member end 18 has 5 lower extremities 24 that are open or hollow. The frame member 16 is formed of metal stock or tubing and has a cross-sectional configuration which can be rectangular, circular, or any other suitable configuration. The frame member 16 also can be formed from a suitable strong, 10 molded synthetic plastic or composition material so long as it is rigid and hollow. Additionally, the frame member 16 can be of any suitable configuration other than the U-shape that is illustrated.

The unitary seat and lower backrest portion 14 15 includes a unitary frame assembly formed of hollow tubular stock similar to that of the frame member 16. The assembly includes a pair of like inverted U-shaped members, each providing a pair of depending legs 26 braced by a cross-member 28. Each pair of legs 26 is 20 connected by an upper saddle or bridge segment 30. The bridging segments 30 are spaced apart the distance between the conjoined leg pairs 26.

A combination seat and lower backrest frame 32 is secured between the bridging or saddle segments 30. The combination frame 32 likewise is formed of tubular stock 25 and includes a horizontally oriented seat-retaining portion 34 of generally U-shaped configuration and an upstanding backrest portion formed as an extension of the seat portion 34. The seat portion 34 includes a pair of side segments 36 connected at the front end of the chair by a front segment 38. Extending upwardly from each side segment 36 at the rear end of the chair 10 are straight segments 40 which are hollow and open at their respective upper extremities 42. The segments 40 are arranged in 30 parallel relationship and are spaced apart laterally the same distance as the depending frame member ends 18. The upstanding segments 40 thereby cooperate to provide the 35

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lower backrest frame portion of the chair 10. As FIG. 1 illustrates, the members 18 and 40 are interconnected, i.e., each member 18 is aligned and is in registry with a respective member 40. The joint or juncture between each 5 of the interconnected members 18 and 40 is concealed by a bellows-like appearing flexible sleeve 44 so that the backrest 12 of the chair 10 appears to be unitary. A seat pad or cushion 46 is installed on the seat frame members 36 and 38. The backrest pad 22 can include an 10 optional lower backrest pad portion 48 positioned between the lower backrest segments 40. The chair construction is such that the lower backrest portion 48 can be omitted, if desired, without sacrificing the utility of the chair, or a separate pad, not shown, can be 15 installed.

FIGS. 2-4 illustrate flexible spring means embodying the invention for conjoining or connecting the upper and lower backrest frame portions 12 and 14. A pair of identical spring means is installed on a chair so that only 20 one need be described in detail. Each of said spring means 50 includes an upper holder member 52, a lower holder member 54, and a substantially non-extensible flexible insert comprising a flat or blade spring 56 secured at opposite ends 57 thereof within the two holders 52 and 25 54.

The holders 52 and 54 are substantially identical in construction and configuration. Each is a channel formation or generally U-shaped having opposing leg members 58 and 60 joined by a connecting member 62 at end 30 thereof. The upper and lower holder or channel members 52 and 54 are positioned within the open frame ends 18 and 40 respectively and are secured therein by fasteners 64 that extend through the frame ends 18 and 40. Preferably, the channel members 52 and 54 are rigid and 35 are made of aluminum, but can be made of any desired material so long as they restrict movement and function as described. The end 65 of a holder opposite its closed

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end formed by connecting member 62 is open for receiving the blade spring 56.

5        The flat or blade spring 56 is elongated and is secured at its respective ends 57 within the channel members 52 and 54 by fasteners 66. As best seen in FIG. 4, each end 57 of the blade spring 56 is secured within a channel member 52 offset from the longitudinal center line or axis of the channel member. The spring 56 is positioned in closer proximity to the front facing leg 58 of the holder because of the desired greater flex or travel of the spring in one direction away from the front end of the chair 10. As seen in FIGS. 2 and 3, spring 56 can enable the desired flexing of the upper backrest portion 12 relative to the lower backrest portion 14 in the direction of arrow A. Spring 56 preferably is a laminated blade or flat spring, but other spring materials may be feasible so long as the desired flexing and strength is provided.

10       To limit the bending of the upper backrest portion 12 relative to the lower backrest portion 14, the distal ends of each leg member 58 and 60 are formed with outwardly extending flanges 68 and 70. Preferably, the leg members 58 are positioned facing toward the front of the chair 10 and are slightly longer than the leg members 60 which are positioned facing toward the rear of the chair 10. Additionally, the flanges 70 can extend outwardly a greater distance than the flanges 68 so as to provide a more effective limitation to the backward motion of the upper backrest portion 12 typically encountered during use. As illustrated, the flanges 68 and 70 not only limit the desired bending of the backrest frame portions one relative to the other, but they also serve stop formations against which the open ends of the frame members 18 and 40 engage or abut when the channel members 52 and 54 are inserted therein.

15       To assemble the spring means 50, the flat spring 56 is inserted within the channel members 52 and 54 and is

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secured therein by the fasteners 66 to form a single unit. Thereafter, the upper channel member 52 is inserted within the open end of the frame member 18 and the lower channel member 54 is inserted within the open end 5 of the frame member 40. The fasteners 64 are then inserted within corresponding apertures in the frame members 18 and 40 and the channel members 52 and 54 to secure the channel members 52 and 54 within the frame members 18 and 40. In installing the spring means 50, 10 due consideration to proper placement of bellows sleeve 44 will be given before the spring means 50 installation is completed.

In operation, when the upper backrest portion 12 is at rest position as illustrated in FIG. 2, the upper backrest portion 12 is maintained in vertical alignment 15 with the lower backrest portion 14 by the spring means 50. Additionally, due to the length of the flat spring 56 and the positioning of the apertures for the fasteners 66, a slight gap 71 is provided between the two flanges 20 68 as well as a slight gap 72 between the two flanges 70 so as to permit flexing of the upper backrest portion 12 relative to backrest portion 14. Since the front leg 58 is slightly longer than the rear leg 60, the gap 72 between the flanges 70 is slightly larger than the gap 71 25 between the flanges 68. Accordingly, as FIG. 3 illustrates, upon rearward flexing of the upper backrest portion 12 along the line "A," the flange 70 of the upper backrest portion 12 rotates through the larger gap 72 until it engages against the flange 70 of the lower backrest portion 14 and restricts further rearward movement 30 of the upper backrest portion 12. This larger angular displacement of the backrest portion 12 along the line "A" is achieved by reason of the spring 56 being secured in the holders 52 offset from the center line or axis of 35 the aligned holders in a direction away from the flanges 70 and the larger gap 72 therebetween. This enables the spring 56 to be flexed a greater angular distance consis-

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tent with the larger gap 72 for movement of the backrest portion 12. Also to be noted is that the leg 60 of the holder is thicker than the opposing leg 58 for contributing to additional strength at the point of contact where 5 angular movement of the portion 12 is stopped. By so securing the spring 56 offset in the holders 52, maximum strength and extent of angular travel of the spring is realized. Further maximum use of limited space available for the flexing or angular movement of the spring is permitted.

10 During the rearward flexing of the upper backrest portion 12, the flat spring 56 is displaced or flexed. When the user leans forward spring 56 causes automatic return of upper backrest portion 12 along the line "A" to 15 its original at rest position. As upper backrest portion 12 returns to the rest position, flanges 68 restrict forward movement of the upper backrest portion 12 in a manner similar to that of the flanges 70. Since a large forward displacement of the upper backrest portion 12 is 20 typically not desirable in normal use of the chair 10, the gap 71 between the flanges 68 can be smaller. It is to be noted, however, that the size of the flanges 68 and 25 70 as well as the gaps 71 and 72 between them and the length of the leg members 58 and 60 can vary so long as the spring means 50 functions as described.

In every position of the upper backrest portion 12, the sleeve or bellows 44 covers the gaps 71 and 72 between the flanges 68 and 70 and conceals the operative spring means 50.

30 The flexing or deflection of the spring means 50 enables the upper backrest frame part to be displaced from the normal plane of the backrest assembly or relative to the lower backrest frame part as illustrated by FIG. 3. This flexing or displacement of the upper backrest frame part relative to the lower frame part contributes 35 to the desired feature for seating comfort. The chair back flexing features along with optimum user com-

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fort as described in Patent No. 4,603,904 commonly owned herewith likewise are realized by the herein spring means or assembly 50. The channel or holder members will retain their structural specifications over long periods 5 of chair use while preventing undue flexing of the spring 56.

FIGS. 5-8 illustrate the backrest frame assembly for a chair embodying the invention which is designated generally by the reference numeral 80. The backrest frame 10 assembly 80 includes a frame 82 having an upper frame part or portion 84, a lower frame part or portion 86, and a unitary seat and leg portion 88.

As FIG. 8 illustrates, the upper frame part 84 includes a peripheral, inverted U-shaped frame member 90 providing a pair of spaced apart, depending frame member ends 92 connected across the upper ends thereof by a curved bridging segment 94. Each frame member end 92 has lower extremities 96 that are open or hollow. The frame member 90 is formed of metal stock or tubing and has a cross-sectional configuration which can be rectangular, circular, or any other suitable configuration. The frame member 90 also can be formed from a suitable strong, molded synthetic plastic or composition material so long as it is rigid and hollow. Additionally, the frame member 90 can be of any suitable configuration other than the U-shape that is illustrated. It is to be noted that the spacing of the frame member ends 92 is somewhat less than the spacing of the ends 18 of the parent application in order to provide a centrally supported backrest as 20 will be described hereinafter.

A backrest or chair back 98 preferably is secured to the frame member 90, such as, for example, by ears 100 which can include apertures 102 that accept fasteners (not illustrated). The ears 100 can be secured to the 35 frame by welding or any other desired way.

The backrest 98 overlays the frame member 90 and extends a desired distance outwardly away from both of the

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frame member ends 92 and above the bridging segment 94. Accordingly, the backrest 98 is centrally connected to the seat portion 88 while providing the desired flexing. Furthermore, a variety of backrests 98 can be utilized having different shapes, sizes and materials and including padding, if desired, which are easy to install and replace.

5 The lower frame part 86 includes two laterally spaced portions 104 joined by a plate 106 which in turn is secured to the bottom of the seat portion 88. The lower frame portions 104 likewise are formed of tubular stock and include an upstanding backrest portion formed as curved segments 108 which are hollow and open at their respective upper extremities 110 and are formed substantially perpendicular to the bottom of the portions 104. The segments 108 are arranged in parallel relationship and are spaced apart laterally the same distance as the depending frame member ends 92. The upstanding segments 108 thereby cooperate to provide the lower frame portion 10

15 of the backrest frame assembly 80. As FIG. 8 illustrates, the members 92 and 108 are interconnected, i.e., each member 92 is aligned and is in registry with a respective member 108. The joint or juncture between each of the interconnected members 92 and 108 can be covered by a bellows-like appearing flexible sleeve 112.

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The unitary seat and leg portion 88 includes a seat member 88a and a unitary frame assembly formed of steel rod or hollow tubular stock similar to that of the frame member 90. As FIG. 6 illustrates, the seat and leg portion 88 includes a pair of like substantially rectangular members 113, each providing a pair of depending legs 114. Each pair of legs 114 is connected by upper and lower saddle or bridge segments 116 and 118, respectively. The upper bridging segments 116 are spaced apart the width of the seat portion 88a. A cross-member 119 can also be provided between the two leg members 114 for stability. It is to be understood that the size and type of leg mem- 30

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bers 114 can vary. Furthermore, the seat member 88a, like the backrest 98, can be a variety of different shapes, sizes and materials and can be padded.

5 FIG. 7 illustrates the flexible spring means 50 embodying the parent application for conjoining or connecting the upper and lower frame parts 84 and 86. For ease of description, FIG. 7 has been labelled with the appropriate reference numerals used in the parent application which correspond to similar elements of the spring means 50. Thus, reference is to be made to the above description of FIGS. 2-4 as provided in the parent application for details with regard to the structure of the spring means 50. The operation of spring means 50 is substantially the same as in the parent application.

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15 As FIGS. 5, 6 and 7 illustrate, both of the spring means 50 are completely enclosed by a protective cover 120. The protective cover 120 also covers a portion of the upper and lower frame parts 84 and 86. The remaining portions of the upper and lower frame parts 84 and 86 20 respectively can be concealed within the backrest 98 and the seat portion 88 or can be connected to the back of the backrest 98 and bottom of the seat portion 88. Thus, as FIG. 5 shows, the backrest frame assembly 80 can be designed with a smooth transition between the backrest 98 25 and the seat portion 88.

30 This smooth transition not only enhances the appearance of the backrest frame assembly 80, but prohibits foreign matter including articles of clothing, fingers, or similar items from being caught in the spring means 50. It is to be noted that the protective cover 120 can be secured at opposite ends to the backrest 98 and the seat portion 88 and can be sufficiently resilient to permit the desired flexing of the backrest 98.

35 The simplicity and economy of spring means 50 and its installation between the upper and lower frame parts can be readily appreciated. Simple tooling and parts are involved. Minor variations in dimensions and configuration

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of components parts of the invention may occur to the skilled artisan without departing from the scope of the invention as set forth in the appended claims.

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CLAIMS

1. A flexible, articulated backrest frame assembly adapted to be installed between a backrest member and chair seat member to form a flexible backrest for a chair, said frame assembly comprising:
  - a. a lower frame part having a pair of hollow, spaced apart frame members joined together at one end of each and open at their opposite ends;
  - b. an upper frame part having a pair of hollow, spaced apart frame members and open ends in registry with the open ends of the lower frame members;
  - c. spring means secured between said open ends of the frame members to provide an articulated flexible spring connection between the upper and lower frame parts;
  - d. said frame parts having means for attaching same to a backrest member and chair seat member respectively to form the flexible backrest for the chair.
2. The backrest frame assembly as defined in claim 1 in which said upper and lower frame parts are adapted to be installed between the backrest and seat members concealed from viewing from the exterior of the chair.
3. The backrest frame assembly as defined in claim 2 which is a unitary assembly.
4. The backrest frame assembly as defined in claim 2 including resilient cover means for enclosing said backrest frame assembly so that a smooth aesthetically pleasing transition is provided between said backrest member and said chair seat member while protecting said backrest frame assembly from foreign elements without inhibiting the desired flexing thereof.
5. The backrest frame assembly as defined in claim 1 wherein each spring means include a pair of elongate holder members of like, substantially U-shaped configuration closed at one end thereof and open at the opposite end

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thereof, a substantially non-extensible flexible insert secured in said holder members adjacent said closed ends thereof and extending through said open ends thereof between the holder members, said open ends facing toward  
5 and spaced one from the other to form a gap therebetween, said holder members being installed relative to said registered pair of frame members so as to maintain the flexible insert extending therebetween, said opposite ends of the holder members each having cooperating restrictive  
10 flange engagement means integral therewith and extending outwardly of said open extremities for limiting flexing of the insert beyond the tensile limit thereof in diametrically opposite directions of movement of said upper and lower frame parts.

15 6. The backrest frame assembly as defined in claim 5 wherein said holder members are secured within the interiors of said frame members and said flexible insert is a flat laminated spring member secured at its opposite ends in said holder members offset from the longitudinal center line or axis of the holder members.

20 7. The backrest frame assembly as defined in claim 5 wherein said engagement means comprise a pair of flanges on said opposite ends of each of said holder members, each flange of the pair extending in a direction outwardly of said holder member and in opposite directions one relative to the other with the opposing flanges of opposite holder members being spaced one from the other to provide gaps therebetween and wherein said holder members are constructed of a substantially rigid material so that upon flexing of said insert said flanges engage one another to limit the flexing of said insert.

25 8. The backrest frame assembly as defined in claim 7 wherein one flange of a pair of flanges is larger than the second flange of the pair, and the larger flange faces toward the rear end of the chair, the gap between said larger flanges being greater in width than that of the gap between the smaller flanges.

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9. A chair comprises, a backrest portion, a seat assembly which includes a support frame and depending leg members, and a backrest frame assembly installed between the backrest portion and the seat assembly to provide a flexible backrest for said chair, said backrest frame assembly including a lower frame part having a pair of spaced apart frame members secured upstanding relative to the seat assembly, an upper frame part having a pair of spaced apart depending frame members arranged in registry with the upstanding frame members, said frame members being hollow with open extremities, said upper frame part having said backrest portion secured thereto and overlaying said upper frame part, spring means secured between each registered pair of frame members to provide an articulated, flexible spring backrest for the chair, and resilient cover means for enclosing said backrest frame assembly so that a smooth aesthetically pleasing transition is provided between said seat assembly and said backrest portion while protecting the backrest frame assembly from foreign elements without inhibiting the desired flexing thereof.

10. The chair as defined in claim 9 wherein each spring means include a pair of elongate holder members of like, substantially U-shaped configuration closed at one end thereof and open at the opposite end thereof, a substantially non-extensible flexible insert secured in said holder members adjacent said closed ends thereof and extending through said open ends thereof between the holder members, said open ends facing toward and spaced one from the other to form a gap therebetween, said holder members being installed relative to said registered pair of frame members so as to maintain the flexible insert extending therebetween, said opposite ends of the holder members each having cooperating restrictive flange engagement means integral therewith and extending outwardly of said open extremities for limiting flexing of the insert beyond the tensile limit thereof in diametrically

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opposite directions of movement of said upper frame part relative to the front facing end of the chair.

11. The chair as defined in claim 10 wherein said holder members are secured within the interiors of said frame members and said flexible insert is a flat laminated spring member secured at its opposite ends in said holder members offset from the longitudinal center line or axis of the holder members.

10 12. The chair as defined in claim 10 wherein said engagement means comprise a pair of flanges on said opposite ends of each of said holder members, each flange of the pair extending in a direction outwardly of said holder member and in opposite directions one relative to the other with the opposing flanges of opposite holder members being spaced one from the other to provide gaps therebetween and wherein said holder members are constructed of a substantially rigid material so that upon flexing of said insert said flanges engage one another to limit the flexing of said insert.

20 13. The chair as defined in claim 12 wherein one flange of a pair of flanges is larger than the second flange of the pair, and the larger flange faces toward the rear end of the chair, the gap between said larger flanges being greater in width than that of the gap between the smaller flanges.

25 14. The chair as defined in claim 10 wherein each of said spring means is enclosed by a flexible bellows member within said resilient cover means.

30 15. The chair as defined in claim 9 wherein at least a portion of at least one of said upper and lower frame parts is concealed within said backrest portion and seat assembly respectively.

35 16. A chair comprising, a backrest portion, a seat assembly which includes a support frame and depending leg members, and a backrest frame assembly installed between the backrest portion and the seat assembly, said backrest frame assembly including a lower frame part having a pair

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of spaced apart frame members secured upstanding relative to the seat assembly, an upper frame part having a pair of spaced apart depending frame members arranged in registry with the upstanding frame members, said frame members being hollow with open extremities and being spaced apart a distance less than the width of said seat assembly, said upper frame part having said backrest portion secured to a front surface thereof and overlaying said upper frame part a predetermined distance, spring means secured between each registered pair of frame members to provide an articulated, flexible spring backrest for the chair, each spring means including a pair of elongate holder member of like, substantially U-shaped configuration closed at one end thereof and open at the opposite end thereof, one leg of each holder member being thicker and shorter than the opposing leg thereof and facing towards the rear of the chair, a substantially non-extensible flexible spring secured off-center in said holder members relative to the longitudinal center line of said holder members and adjacent said closed ends thereof and extending through said open ends thereof between the holder members, said open ends facing toward and spaced one from the other to form a gap therebetween, said holder members being installed inside said registered pair of frame members with the flexible spring extending therebetween, said holder members each having flange means integrally formed on said leg adjacent said open ends of the holders and protruding outwardly of the open extremities and into the spacing between the upper and lower frame parts, said flange means constructed and arranged to limit angular movement of the upper frame part in diametrically opposite directions by interengagement between protruding opposing flange means whereby to limit flexing of the spring beyond the tensile limit thereof, and a substantially flexible protective cover for enclosing said backrest frame assembly, said cover being capable of protecting said backrest frame assembly

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from foreign elements while enabling the desired flexing of said backrest portion so that a smooth aesthetically pleasing transition is achieved between said seat assembly and said backrest portion.

5 17. The chair as defined in claim 16 wherein said spring is a flat spring secured at its opposite ends adjacent the closed ends of the holder members.

10 18. The chair as defined in claim 17 wherein the legs of each of the holder members have integral flanges extending in a direction outwardly of the holder members and in opposite directions one relative to the other, said flanges on the thicker legs of the holder members being spaced apart a distance greater than the spacing between flanges on the thinner legs of the holder members 15 and related to the offset securement of the spring in the holder members to enable a greater angular movement of said upper frame part in the direction toward the rear end of the chair.

20 19. The chair as defined in claim 16 wherein each of said spring means is enclosed by a flexible bellows member within said protective cover.

25 20. The chair as defined in claim 16 wherein at least a portion of at least one of said upper and lower frame parts is concealed within said backrest portion and seat assembly respectively.

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FIG. 1

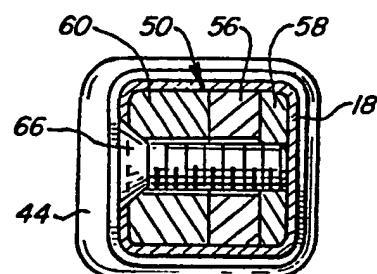
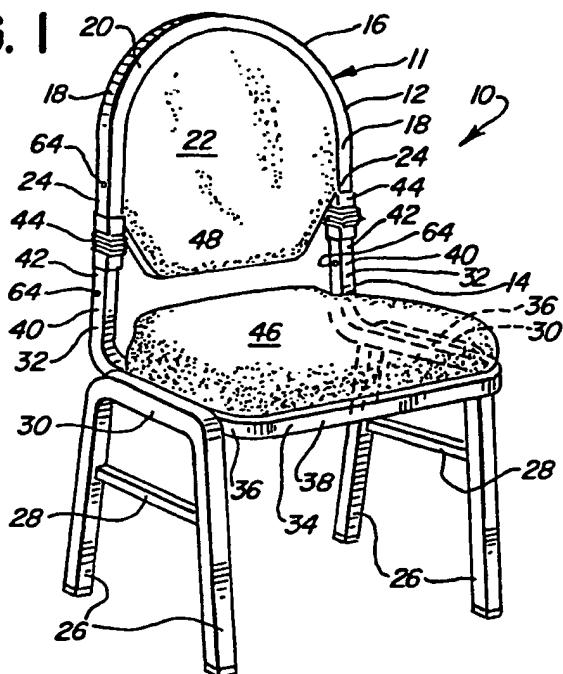


FIG. 4

FIG. 2

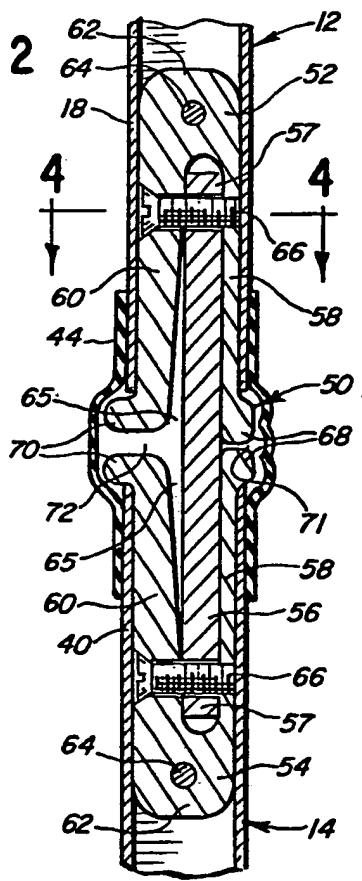
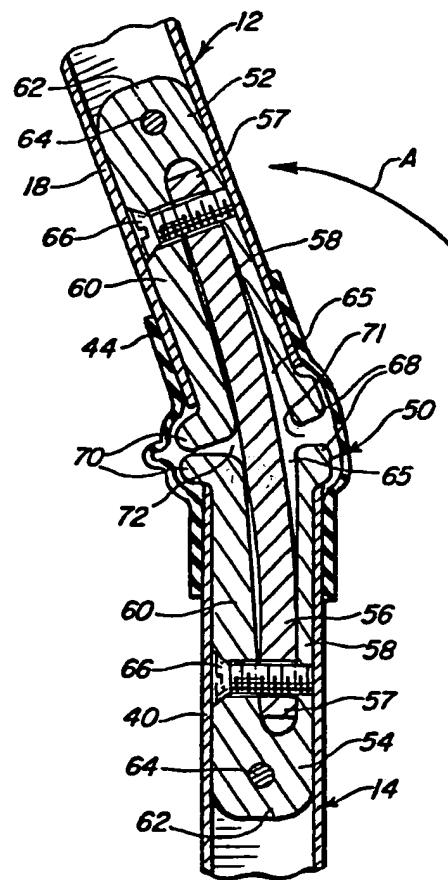
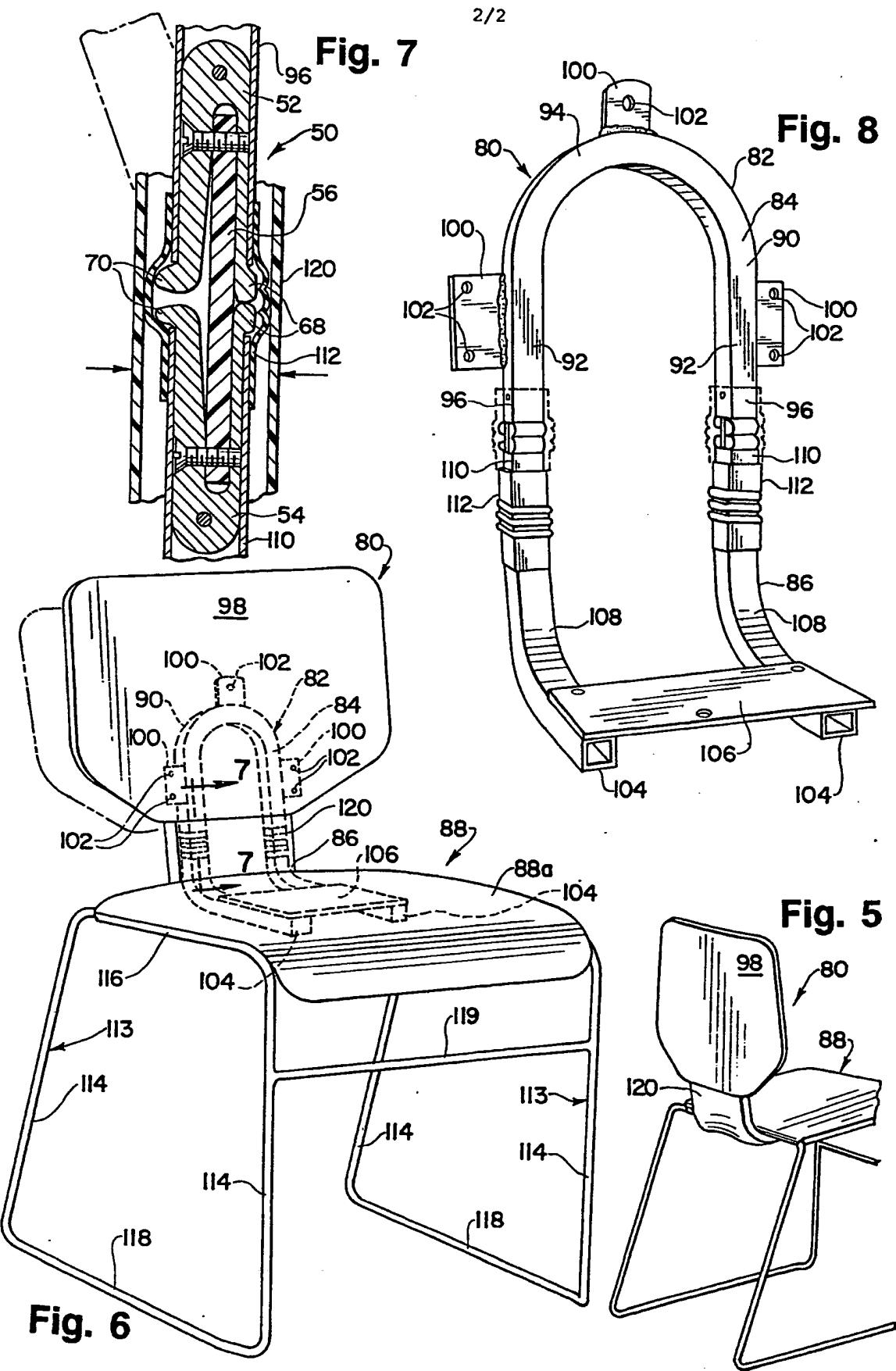


FIG. 3



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# INTERNATIONAL SEARCH REPORT

International Application No. PCT/US90/05073

## I. CLASSIFICATION & SUBJECT MATTER (If several classification symbols apply, indicate all) <sup>3</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC  
 IPC (5) : A 47C 1/024  
 U.S. Cl : 297/296, 297, 300, 306

## II. FIELDS SEARCHED

Minimum Documentation Searched <sup>4</sup>

Classification System	Classification Symbols
U..S	297/285, 296, 297, 299, 300, 302, 306
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>5</sup>	

## III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>14</sup>

Category <sup>6</sup>	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>			Relevant to Claim No. <sup>18</sup>
X	US,A 4,157,203 (AMBASZ) See Figure 14.		05 June 1979	1-4,9,15
X	US,A 4,580,836 (VERNEY) See Figure 2.		08 April 1986	1
A	US,A 4,711,491 (GINAT)		08 December 1987	1
A	US,A 2,732,005 (CORNING)		24 January 1956	1
A	FR,A 860,938 (FAURE)		28 January 1941	1
A	GB,A 2,038,174 (AMBASZ)		23 July 1980	1

\* Special categories of cited documents: <sup>15</sup>

"A" document defining the general state of the art which is not considered to be of particular relevance  
 "E" earlier document but published on or after the international filing date  
 "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)  
 "O" document referring to an oral disclosure, use, exhibition or other means  
 "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

## IV. CERTIFICATION

Date of the Actual Completion of the International Search <sup>19</sup>

29 OCTOBER 1990

Date of Mailing of this International Search Report <sup>20</sup>

28 JAN 1991

International Searching Authority <sup>21</sup>

ISA/US

Signature of Authorized Officer <sup>22</sup>

PETER R. BROWN